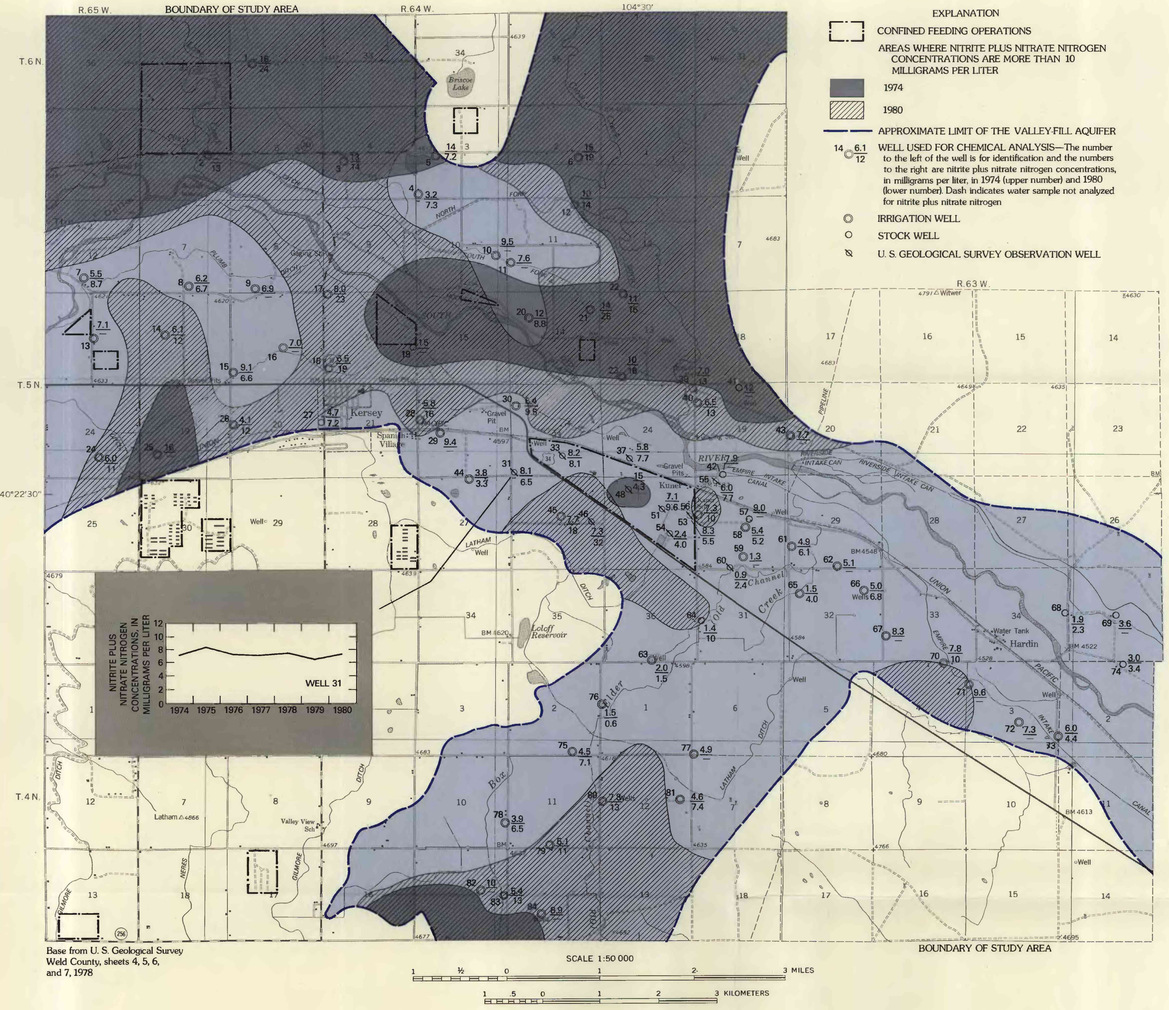

Base from U. S. Geological Survey
Weld County, sheets 4, 5, 6, and 7, 1978

SCALE 1:50 000
1 ½ 0 1 2 3 MILES
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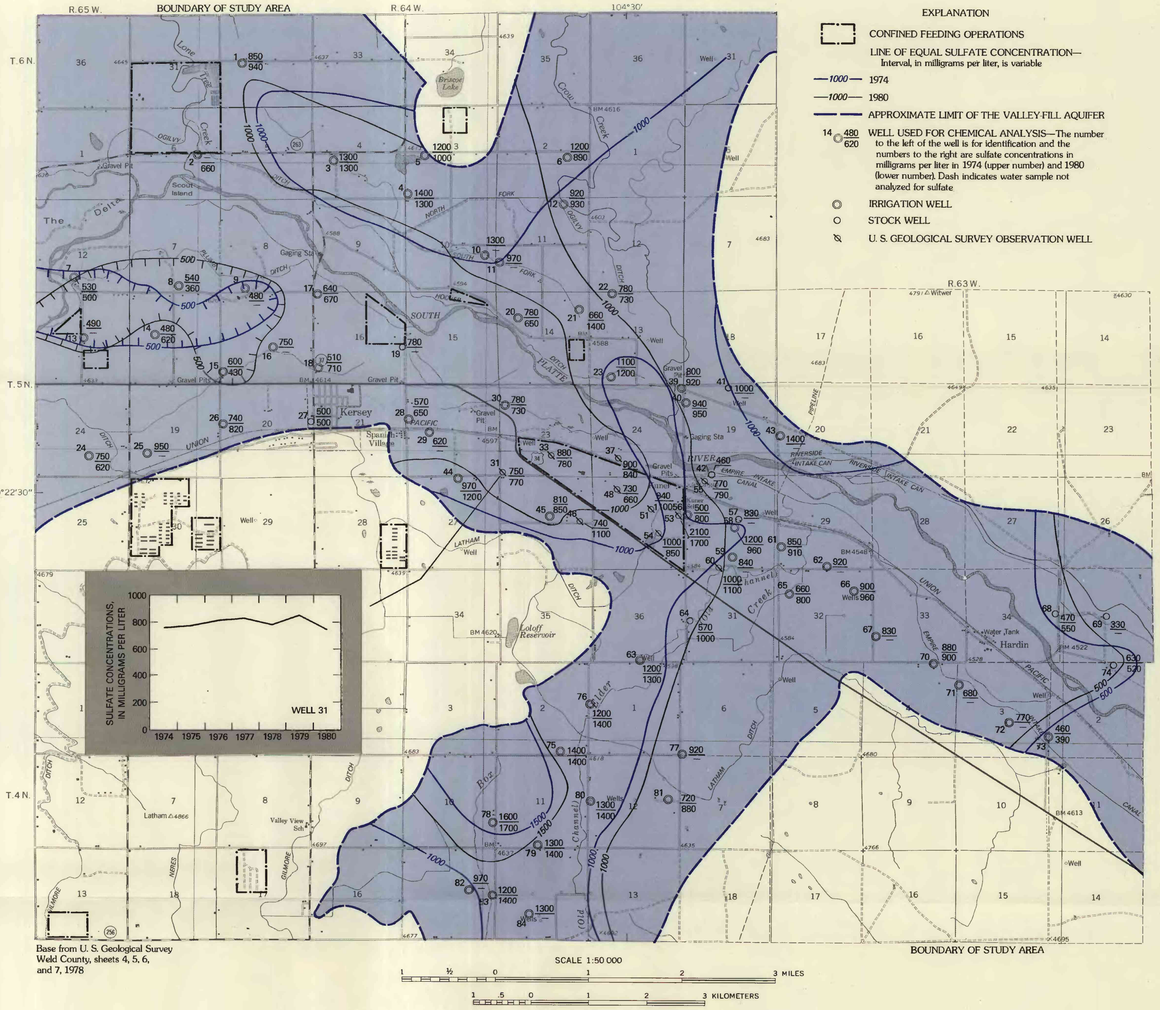
Figure 4. -- Nitrite plus nitrate nitrogen concentrations, 1974 and 1980.



Base from U. S. Geological Survey
Weld County, sheets 4, 5, 6, and 7, 1978

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Figure 5. -- Sulfate concentrations, 1974 and 1980.

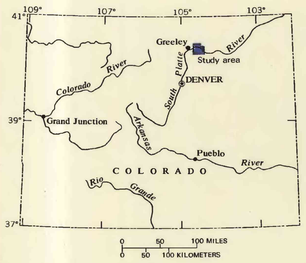

Figure 1. -- Location of study area.

INTRODUCTION

Ground water is used extensively for agriculture along the South Platte River in the study area, which is about 10 miles east of Greeley and about 50 miles northeast of Denver, Colo. (fig. 1). Significant changes in the quality of ground water may result from use and reuse of water from a stream-aquifer system for irrigated crops, extensive use of crop fertilizers, and operation of cattle feedlots and poultry farms. To help water users and managers better understand the effects of land use on ground-water resources, this report presents data on nitrite plus nitrate, sulfate, chloride, and manganese concentrations, which are good indicators of the water quality, and a brief description of the geology and hydrology of the study area.

This investigation could not have been completed without the cooperation of the well owners in the study area who allowed their wells to be sampled. Their help is gratefully acknowledged.

HYDROGEOLOGIC SYSTEM

The bedrock underlying the study area is the Laramie Formation (Upper Cretaceous), which crops out in the uplands south of Kersey. The Laramie Formation consists of olive-gray silty shale containing lenticular beds of sandstone, numerous beds of carbonaceous clay, and seams of lignite. As part of the Laramie-Fox Hills aquifer, the Laramie Formation yields small to moderate supplies of water to industrial, public-supply, domestic, and stock wells (Smith and others, 1964, pl. 1).

The major source of ground water in the study area is the valley-fill aquifer, which consists of unconsolidated alluvial deposits that fill a valley system eroded in the underlying Laramie Formation. The aquifer includes the South Platte River alluvium, the Box Elder Creek alluvium, the Crow Creek alluvium, and the South Platte River terrace deposits. The valley-fill deposits consist of interbedded clay, silt, sand, gravel, and some cobbles and boulders that yield large quantities of water to irrigation, industrial, domestic, and stock wells (Smith and others, 1964, p. 26, pl. 1). These deposits are as much as 200 feet thick in the study area.

Smith and others (1964, p. 54-67) reported that the discharge from 886 wells, mostly drilled into the valley-fill deposits and located within an area from just north of Denver to near Kersey averaged 700 gallons per minute and ranged from 45 to 2,040 gallons per minute. Also, an aquifer test on a well at Kersey, which was pumping at the rate of 1,125 gallons per minute, indicated that the transmissivity of the valley-fill aquifer near the well is 44,220 feet squared per day.

The major sources of surface water flowing into the study area are the South Platte River and its major tributary, the Cache la Poudre River. Both are perennial streams whose headwaters begin at the Continental Divide in the Rocky Mountains. Other smaller tributaries to the South Platte River are Lone Tree Creek and Crow Creek, both of which originate in the mountains near Cheyenne, Wyo., and Box Elder Creek, which begins in the plains about 90 miles south of the study area. These smaller tributaries are ephemeral for most of their length, flowing only in response to rainstorms and irrigation runoff.

The major sources of recharge to the valley-fill aquifer are seepage from irrigation canals and streambeds, applied irrigation water, and precipitation. Precipitation is the largest source of recharge where the valley-fill deposits are bordered by dune sand deposits north and south of Hardin because the sand allows the precipitation to soak through rather than run off. Because most of the underlying Laramie Formation is shale and clay, very little of the ground water in the valley-fill aquifer is lost by downward flow into the bedrock. A water-level contour map showing 1968 water levels (Hurr and others, 1972) is shown in figure 2. Flow is generally toward the South Platte River and in the direction of streamflow. In the alluvium of Crow and Box Elder Creeks, the ground-water flow is parallel to the stream valleys. Borman (1981) estimated the velocity of the ground water flowing under the large feedlot at Kersey to be 230 feet per year.

LAND USE

A map showing land use (fig. 3) indicates that most of the study area is cropland and pasture, followed in order of decreasing area by mixed rangeland, forested wetland, and confined feeding operations. The irrigation of cropland and the operation of confined-feeding lots may affect the water quality of the valley-fill aquifer if nitrogen leached from the crop fertilizer and nitrogen and chloride leached from the manure moves into the ground water.

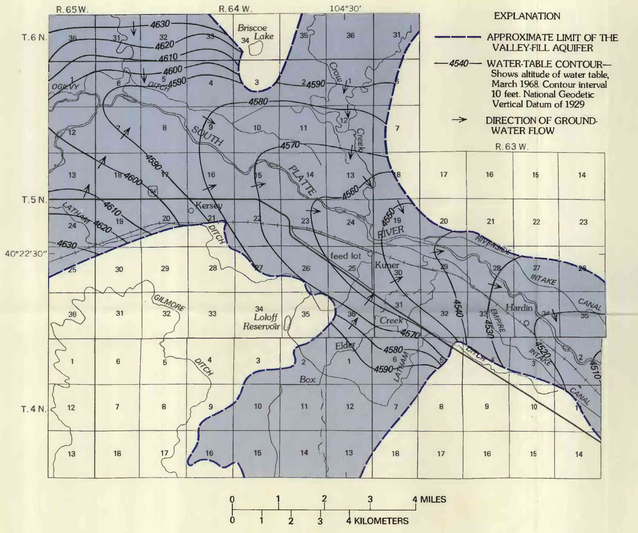

Figure 2. -- Contours on the water table in the valley-fill aquifer (from Hurr and others, 1972).

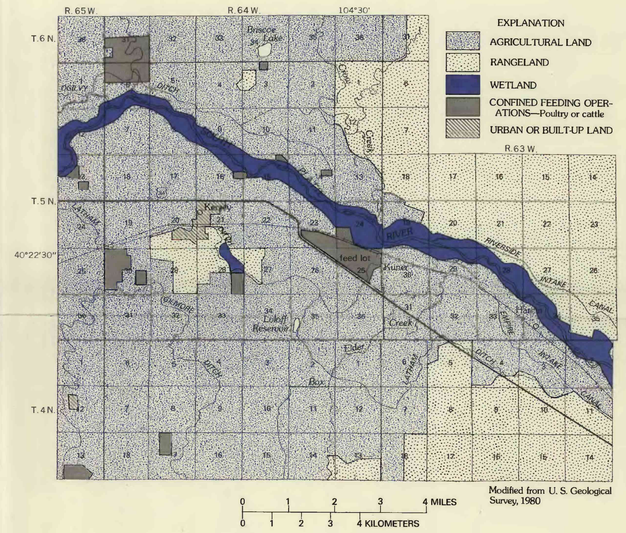

Figure 3. -- Land use.

NITROGEN, SULFATE, CHLORIDE, AND MANGANESE IN GROUND WATER IN THE ALLUVIAL DEPOSITS OF THE SOUTH PLATTE RIVER VALLEY NEAR GREELEY, WELD COUNTY, COLORADO

By
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1984